

**ABSTRACT OF THE DISCLOSURE**

The invention described herein relates to new titanium-comprising materials which can be utilized for forming titanium alloy sputtering targets. The titanium alloy sputtering targets can be reactively sputtered in a nitrogen-comprising sputtering atmosphere to form an alloy TiN film, or alternatively in a nitrogen-comprising and oxygen-comprising sputtering atmosphere to form an alloy TiON thin film. The thin films formed in accordance with the present invention can have a non-columnar grain structure, low electrical resistivity, high chemical stability, and barrier layer properties comparable to those of TaN for thin film Cu barrier applications. Further, the titanium alloy sputtering target materials produced in accordance with the present invention are more cost-effective for semiconductor applications than are high-purity tantalum materials and have superior mechanical strength suitable for high-power sputtering applications.